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1765

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/689,617

Applicant(s)

OKAMOTO, SATORU

Examiner

Lan Vinh

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 November 2005 and 19 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-95 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 85-95 is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-25, 28-84 is/are rejected.
- 7) ☒ Claim(s) 5, 26 and 27 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment/Argument

1. Applicant's arguments, see pages 26-30 of the response, filed 11/8/2005, with respect to the rejection(s) of claim(s) 1-84 under 35 U.S.C 102(b) based on Ye (US 5,756,400) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration and search, a new ground(s) of rejection of claims 1-84 under 35 U.S.C 102(e) and 35 U.S.C 103(a) are made in view of newly cited references of Chow et al (US 6,872,322) and Lu et al (US 6,352,081)

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-4, 7 are rejected under 35 U.S.C. 102(e) as being anticipated Chow et al (US 6,872,322)

Chow discloses a method for cleaning a plasma etching chamber comprising the steps of:

forming a polysilicon/semiconductor film over a substrate and a tungsten silicide /conductive layer over the semiconductor film (col 11, lines 1-3)

filling a chamber with Cl₂ and generating plasma from the Cl₂ to clean the chamber (col 11, lines 35-42)

placing the wafer/substrate with the polysilicon/semiconductor film and a tungsten silicide /conductive layer in the chamber being cleaned with added cleaning gas/cleaned chamber to etch the conductive film in the cleaned chamber by repeating the etching steps (col 10, lines 52-57; col 11, lines 1-20; fig. 3)

Regarding claim 2, Chow discloses using an ICP etching method (col 6, lines 35-40)

Regarding claims 3-4, Chow discloses that the fluorine gas is CF₄ (col 9, lines 37-40), forming a silicon oxide layer between the polysilicon and tungsten layers (col 8, lines 15-17)

Regarding claims 5, 7, Chow discloses adding oxygen gas to the cleaning plasma (col 9, lines 37-40), fig. 1d of Chow shows an island shaped semiconductor structure is formed

4. Claims 8-13, 22-25, 28 are rejected under 35 U.S.C. 102(e) as being anticipated Chow et al (US 6,872,322)

Chow discloses a method for cleaning a plasma etching chamber comprising the steps of:

placing a substrate having a first polysilicon layer/conductive film and a second conductive film of tungsten silicide over the first conductive film within a chamber (col 11, lines 1-3)

etching the first conductive film and the second conductive film within the chamber using an etching gas and cleaning the chamber with a plasma generated from Cl₂ or a mixed gas of Cl₂ and a fluorine-based gas after the first conductive film and the second conductive film have been etched, etching the second conductive film within the cleaned chamber by repeating the etching step (col 10, lines 52-57; col 11, lines 1-20; fig. 3)

Regarding claims 9, 23, Chow discloses using an ICP etching method (col 6, lines 35-40)

Regarding claim 10, 24, Chow discloses that the fluorine gas is CF₄ (col 9, lines 37-40)

Regarding claims 25-28, Chow discloses forming a silicon oxide layer between the polysilicon and tungsten layers (col 8, lines 15-17)

The limitation of claims 11,13 have been discussed above

Regarding claim 12, Chow discloses adding oxygen gas to the cleaning plasma (col 9, lines 37-40)

5. Claims 15-19, 21 are rejected under 35 U.S.C. 102(e) as being anticipated Chow et al (US 6,872,322)

Chow discloses a method for cleaning a plasma etching chamber comprising the steps of:

placing a substrate having a conductive film of tungsten silicide within a chamber (col 11, lines 1-3)

cleaning the chamber with a plasma generated from Cl₂, etching the conductive film within the cleaned chamber by repeating the etching step (col 10, lines 52-57; col 11, lines 1-20; fig. 3)

Regarding claim 16, Chow discloses using an ICP etching method (col 6, lines 35-40)

Regarding claim 17, Chow discloses that the fluorine gas is CF₄ (col 9, lines 37-40)

The limitation of claim 18 has been discussed above

Regarding claim 19, Chow discloses adding oxygen gas to the cleaning plasma (col 9, lines 37-40)

Regarding claim 21, Chow discloses using a etching gas mixture of Cl₂, SF₆ and oxygen (col 9, lines 36-51)

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 29-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow et al (US 6,872,322) in view of Ye et al (US 5,765,400)

Chow discloses a method for cleaning a plasma etching chamber comprising the steps of:

filling the chamber with Cl₂ and generating plasma from the Cl₂ to clean the chamber (col 11, lines 35-40), a ceiling of the chamber is made of transparent dielectric material, the ceiling is exposed to the inside of the chamber (col 6, lines 29-32; fig. 2), which reads on a exposed part of the chamber is made from quartz, applying a dielectric magnetic field through the ceiling/quartz and the electrode to generate plasma (col 6, lines 30-54), etching residues are adhered to the chamber surface that includes the ceiling/quartz surface (col 11, lines 40-42)

Unlike the instant claimed invention as per claim 29, 35, Chow fails to disclose that BO_x/residue is adhered to the surface of the quartz and etching to remove Box from the chamber

Ye discloses a method for cleaning a plasma etching apparatus comprising a step of cleaning an inner surface of a chamber with chlorine containing gas to remove BO_x adhered to the chamber surface (Table 1)

Since Chow is concerned with an etching step using Cl₂, one skilled in the art at the time the invention was made would have found it obvious that Chow etching step would have resulted in BO_x/residue adhered to the surface of the chamber in view of Ye teaching because Ye discloses that during a chlorine base etch process, non-volatile contaminants are deposited on the chamber wall/inner surface of the chamber (col 7, lines 60-67, col 8, lines 1-5). One skilled in the art at the time the invention was made would also have found it obvious to employ Chow cleaning step to remove Box from an inner surface of the chamber in view of Ye teaching because Ye discloses that the

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concept of using the halogenated gas mixture to remove by-products is applicable to semiconductor processing chambers in general (col 6, lines 40-45)

Regarding claim 30, Chow discloses using an ICP etching method (col 6, lines 35-40)

Regarding claim 31, Chow discloses that the fluorine gas is CF₄ (col 9, lines 37-40)

The limitation of claims 32, 34 have been discussed above

Regarding claim 33, Chow discloses adding oxygen gas to the cleaning plasma (col 9, lines 37-40)

Regarding claim 21, Chow discloses using a etching gas mixture of Cl₂, SF₆ and oxygen (col 9, lines 36-51)

8. Claims 36-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al (US 6,352,081) in view of Izawa et al (US 6,842,658)

Lu discloses a method of cleaning processing chamber. The method comprises the steps of:

performing plasma etching using a gas containing BCl₃ as an etching gas in the chamber (col 9, lines 50-55), changing/replacing the etching gas with Cl₂ gas after the plasma etching (col 10, lines 60-65), generating plasma from the Cl₂ (col 10, lines 63-65), the chamber includes a quartz exposed to the inside of the chamber (col 7, lines 15-20; fig. 2C)

Unlike the instant claimed invention as per claim 36, Lu fails to expressly disclose applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode

Izawa discloses a method of manufacturing a semiconductor device comprises a step of applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode (col 8, lines 50-54; fig. 3)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Lu step of generating plasma by applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode as per Izawa because Izawa discloses that introducing the magnetic field of the coil will discharge in the vacuum of the plasma to create plasma (col 8, lines 15-18)

Regarding claim 37, Lu discloses using an ICP etching method (col 8, lines 42-45)

Regarding claims 38-39, 41, Lu discloses that the fluorine gas is CF_4 (col 8, lines 49-50), using a quartz plate in the chamber (col 8, lines 46-48)

Regarding claim 42, Lu discloses adding oxygen gas to the cleaning plasma (col 10, lines 62-64)

9. Claims 43-48, 50-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al (US 6,352,081) in view of Izawa et al (US 6,842,658)

Lu discloses a method of cleaning processing chamber. The method comprises the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber (col 9, lines 50-55), changing/replacing the etching gas with Cl_2 gas after the plasma etching (col 10, lines 60-65), generating plasma from the Cl_2 (col 10, lines 63-65) before etching with SF_6 /a gas that is inhibited from generating Box (col 11, lines 40-

45) the chamber includes a quartz exposed to the inside of the chamber (col 7, lines 15-20; fig. 2C)

Unlike the instant claimed inventions as per claims 43, 50, Lu fails to expressly disclose applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode

Izawa discloses a method of manufacturing a semiconductor device comprises a step of applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode (col 8, lines 50-54; fig. 3)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Lu step of generating plasma by applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode as per Izawa because Izawa discloses that introducing the magnetic field of the coil will discharge in the vacuum of the plasma to create plasma (col 8, lines 15-18)

Regarding claim 44, 51, Lu discloses using an ICP etching method (col 8, lines 42-45)

Regarding claims 45, 46, 49, 52, 53, 55, Lu discloses that the fluorine gas is CF₄ (col 8, lines 49-50), using a quartz plate in the chamber (col 8, lines 46-48)

Regarding claims 47, 54, Lu discloses adding oxygen gas to the cleaning plasma (col 10, lines 62-64)

10. Claims 57-61, 63, 64-68, 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al (US 6,352,081) in view of Chow et al (US 6,872,322)

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Lu discloses a method of cleaning processing chamber. The method comprises the steps of:

processing a first semiconductor device by performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber (col 9, lines 50-55), changing/replacing the etching gas with Cl_2 gas after the plasma etching (col 10, lines 60-65), generating plasma from the Cl_2 (col 10, lines 63-65) before etching with SF_6 /a gas that is inhibited from generating Box (col 11, lines 40-45)

Unlike the instant claimed inventions as per claim 57, 64, Lu fails to expressly disclose manufacturing a second semiconductor device using the cleaned chamber although Lu discloses performing wafer processing runs (col 12, lines 40-42)

Chow discloses a method for cleaning a plasma etching chamber comprising the steps of processing/manufacturing a second semiconductor device using the cleaned chamber (col 11, lines 14-20)

One skilled in the art at the time the invention was made would have found it obvious to modify Lu method by manufacturing a second semiconductor device using the cleaned chamber because it is conventional in the art as taught by Chow

Regarding claim 58, 65, Lu discloses using an ICP etching method (col 8, lines 42-45)

Regarding claims 59, 60, 63, 66, 67, 70, Lu discloses that the fluorine gas is CF_4 (col 8, lines 49-50), using a quartz plate in the chamber (col 8, lines 46-48)

Regarding claim 68, Lu discloses adding oxygen gas to the cleaning plasma (col 10, lines 62-64)

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11. Claims 71-84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al (US 6,352,081) in view of Izawa et al (US 6,842,658) and further in view of Chow et al (US 6,872,322)

Lu discloses a method of cleaning processing chamber. The method comprises the steps of:

performing plasma etching using a gas containing BCl₃ as an etching gas in the chamber (col 9, lines 50-55), changing/replacing the etching gas with Cl₂ gas after the plasma etching (col 10, lines 60-65), generating plasma from the Cl₂ (col 10, lines 63-65) before etching with SF₆/a gas that is inhibited from generating Box (col 11, lines 40-45) the chamber includes a quartz exposed to the inside of the chamber (col 7, lines 15-20; fig. 2C)

Unlike the instant claimed inventions as per claims 71, 84, Lu fails to expressly disclose applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode

Izawa discloses a method of manufacturing a semiconductor device comprises a step of applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode (col 8, lines 50-54; fig. 3)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Lu step of generating plasma by applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode as per Izawa because Izawa discloses that introducing the magnetic field of the coil will discharge in the vacuum of the plasma to create plasma (col 8, lines 15-18)

Lu also fails to expressly disclose manufacturing a second semiconductor device using the cleaned chamber although Lu discloses performing wafer processing runs (col 12, lines 40-42)

Chow discloses a method for cleaning a plasma etching chamber comprising the steps of processing/manufacturing a second semiconductor device using the cleaned chamber (col 11, lines 14-20)

One skilled in the art at the time the invention was made would have found it obvious to modify Lu method by manufacturing a second semiconductor device using the cleaned chamber because it is conventional in the art as taught by Chow

Regarding claim 72, 79, Lu discloses using an ICP etching method (col 8, lines 42-45)

Regarding claim 73, 74, 80, 81, 83, Lu discloses that the fluorine gas is CF₄ (col 8, lines 49-50), using a quartz plate in the chamber (col 8, lines 46-48)

Regarding claims 75, 82, Lu discloses adding oxygen gas to the cleaning plasma (col 10, lines 62-64)

Claims 77, 84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al (US 6,352,081) in view of Izawa et al (US 6,842,658) and further in view of Chow et al (US 6,872,322) and Ye et al (US 5,765,400) based on the ground of rejection set forth in paragraph 13.

12. Claims 6,14, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow et al (US 6,872,322) in view of Ye et al (US 5,765,400)

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Chow method has been described above. Unlike the instant claimed invention as per claim 6, Chow fails to disclose cleaning includes removing BOx from an inner surface of the chamber

Ye discloses a method for cleaning a plasma etching apparatus comprising a step of cleaning an inner surface of a chamber with chlorine containing gas to remove BOx (Table 1)

Since Chow is directed to a step of cleaning a chamber using chlorine containing gas, one skilled in the art at the time the invention was made would have found it obvious to employ Chow cleaning step to remove Box from an inner surface of the chamber in view of Ye teaching because Ye discloses that the concept of using the halogenated gas mixture to remove by-products is applicable to semiconductor processing chambers in general (col 6, lines 40-45)

13. Claims 42, 49, 56, 62, 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lu et al (US 6,352,081) in view of Izawa et al (US 6,842,658) and further in view of Ye et al (US 5,765,400)

Lu as modified by Izawa has been described above. Unlike the instant claimed invention as per claim 42, 49, 56, 62, 69, Lu and Izawa fails to disclose cleaning includes removing BOx from an inner surface of the chamber

Ye discloses a method for cleaning a plasma etching apparatus comprising a step of cleaning an inner surface of a chamber with chlorine containing gas to remove BOx (Table 1)

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Since Lu is directed to a step of cleaning a chamber using chlorine containing gas, one skilled in the art at the time the invention was made would have found it obvious to employ Lu and Izawa cleaning step to remove Box from an inner surface of the chamber in view of Ye teaching because Ye discloses that the concept of using the halogenated gas mixture to remove by-products is applicable to semiconductor processing chambers in general (col 6, lines 40-45)

Allowable Subject Matter

14. Claims 5, 26, 27 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 85-95 are allowed.

The reasons for allowance of claims 85-95 has been stated in the previous office action

Response to Arguments

15. Applicant's arguments with respect to the references of Ye, Fisher have been considered but are moot in view of the new ground(s) of rejection.

The applicants argue that Ye fails to describe or suggest placing a substrate with a semiconductor film in a cleaned chamber to etch a conductive film (W) formed over the semiconductor film. This argument is moot in view of new ground of rejection based on the reference of Chow that discloses placing a substrate with a semiconductor film in a

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cleaned chamber to etch a conductive film (tungsten silicide) formed over the semiconductor film. It is argued that Fisher fails to describe or suggest quartz adjacent to an electrode for generating plasma. This argument is moot in view of new ground of rejection based on the reference of Izawa discloses a method of manufacturing a semiconductor device comprises a step of applying a dielectric magnetic field generated from the electrode through the quartz adjacent the electrode

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471.

The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>.

LV



March 6, 2006